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Every term of the series is composed of $(p+1)$ prior terms ; also if q be added to any term it will equal $(q+1)$ prior terms.

20. It is then proved that the property of the triangular numbers is not destroyed by adding any (the same) number to each term, it is merely postponed, and commences at a higher number according to the magnitude of the number added.

21. The same is proved in respect of the addition of any common arithmetical series.

22. The paper concludes by suggesting a proof that every number may be composed of 4 triangular numbers, derived from the consideration that if the triangular numbers be indexed or numbered thus—

1	2	3	4	5 &c.	indices.
1	3	6	10	15 &c.	Δ^n nos.

Any number between 2 triangular numbers can be formed by 4 triangular numbers, the sum of whose indices shall be not less than the sum of the indices of the 4 triangular numbers that compose the smaller triangular number, and not greater than the similar indices of the larger; and generally (after a limited number of terms) the sum of the indices of any intermediate number will be exactly the sum of the indices of the smaller number: to illustrate this, all the numbers between 91 and 105 (2 triangular numbers) are shown to consist of 4 triangular numbers, whose indices exactly equal 25, which is the sum of the indices of the 4 triangular numbers into which 91 may be divided—

$$\text{thus } 91 = \overset{6}{21} + \overset{6}{21} + \overset{6}{21} + \overset{7}{28}$$

the sum of the indices $6+6+6+7=25$; and every number between 91 and 105 may be composed of 4 triangular numbers, whose indices added together will equal 25; but the nature of this investigation cannot be made intelligible without reference to the table itself, which the paper contains.

If this attempt is successful, the whole of Fermat's theorem of the polygonal numbers may be proved without reference to Lagrange's proof of the case of the squares (the second case) derived from the properties of the prime numbers. The writer intimates an intention of making further communications on the same subject.

13. "On the Analysis of Numerical Equations." By J. R. Young, Esq., Professor of Mathematics in Belfast College. Communicated by Sir John W. Lubbock, Bart., F.R.S. &c.

The object of this communication is to diminish the labour attendant upon existing methods for the analysis of numerical equations. As Budan pointed out intervals, within the bounds of the extreme limits of the roots of an equation, in which all search for roots would be fruitless, so here the author seeks for what he terms "*rejective intervals*" among those which Budan had retained. This he proposes effecting by transforming the first member of every equation $X=0$ into

$$X=\{F+\sqrt{F^2-X}\}\times\{F-\sqrt{F^2-X}\} \quad . \quad . \quad . \quad . \quad . \quad (1.)$$

which the author calls decomposing it into *conjugate factors*; in

which factors, F is entirely arbitrary. On account of this unrestricted character of F, innumerable changes may be effected on a pair of conjugate factors, without disturbing their product: but it is from the following expression of these factors that the general results in this paper are chiefly deduced: namely,

$$\left.\begin{array}{l} X=\{F+f+\sqrt{F^2+2Ff+f^2-X}\} \\ \quad\times\{F+f-\sqrt{F^2+2Ff+f^2-X}\} \end{array}\right\} \quad . \quad . \quad . \quad . \quad . \quad . \quad (2.)$$

from which it follows that, having decomposed any function X into a pair of conjugate factors (1.), we may always afterwards add any quantity, f, to the rational part of each factor; provided we, at the same time, introduce the expression $2Ff+f^2$ under the radical: and it is upon this general truth that the results in the paper entirely depend, and from which the *rejective intervals* are discovered.

The value of the principle is illustrated by examples taken from Sturm, Fourier, and others; and some general theorems are deduced—applicable to all equations—in reference to the existence of imaginary roots, which furnish some remarkably simple criteria. For instance: it is shown that if, in the general equation of the fourth degree,

$$x^4+ax^3+bx^2+cx+d=0,$$

in which d is positive, the condition

$$4(b-\tfrac{1}{4}a^2)d>c^2$$

exists, all the roots are necessarily imaginary. And that if, in the general equation of the sixth degree,

$$x^6+ax^5+bx^4+cx^3+dx^2+ex+f=0,$$

in which f is positive, the condition

$$4\{d(b-\tfrac{1}{4}a^2)-\tfrac{1}{4}c^2\}f>(b-\tfrac{1}{4}a^2)e^2$$

exists, each member being positive, all the roots are necessarily imaginary.

The paper concludes with some general propositions, derivable from the principles established in the preceding investigations, and which the author conceives to be of value in the analysis of equations.

14. "On some Phenomena and Motions of Metals under the influence of Magnetic Force." By William Sykes Ward, Esq. Communicated by William West, Esq., F.R.S.

In the course of some experiments relative to the principal phenomena of dia-magnetism, the author observed that the nature or direction of the action upon many metals varied with the intensity of the magnetic force, the effects being in accordance with the observations of Professor Plücker; and in pursuing his researches with the view to ascertain how far the magnetic and dia-magnetic forces might be coexistent in the same metal, other phenomena dependent on the power of the magnet presented themselves.

On submitting gold, silver, lead, tin, zinc and cadmium to the action of the electro-magnet when excited by an electric current of moderate strength, or when the polar terminations of the magnet